

For discussion  
on 20 June 2017

**Legislative Council  
Panel on Commerce and Industry**

**Progress Report on Research & Development Centres  
for 2016-17**

**PURPOSE**

This paper provides an annual update on the 2016-17 operation of the five Research and Development (“R&D”) Centres under the purview of the Innovation and Technology Commission (“ITC”).

**BACKGROUND**

2. In April 2006, the Government set up five R&D Centres to drive and co-ordinate applied R&D in selected focus areas. The five Centres are –

- (a) R&D Centre for Information and Communications Technologies under the Hong Kong Applied Science and Technology Research Institute (“ASTRI”);
- (b) Nano and Advanced Materials Institute (“NAMI”);
- (c) Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies (“LSCM”);
- (d) Hong Kong Research Institute of Textiles and Apparel (“HKRITA”); and
- (e) Automotive Parts and Accessory Systems R&D Centre (“APAS”).

3. In December 2015, the Finance Committee (“FC”) of the Legislative Council approved an additional allocation of \$677.6 million from the Innovation and Technology Fund (“ITF”) to support the operation of the R&D Centres up to 31 March 2021 (except ASTRI since its operating expenditure is met separately from Government’s annual recurrent subvention). Since 2006, a total commitment of \$1,696.6 million has been approved to fund the operation of the four R&D Centres.

4. The R&D Centres play an important role in creating a thriving innovation and technology (“I&T”) ecosystem. They act as a focal point for technology collaboration among the Government, industry, academia and research sectors. The R&D Centres not only contribute to the applied research in key areas, but also work closely with the industry, thereby encouraging investment in R&D in Hong Kong, promoting applied research, as well as driving the commercialisation of R&D results.

5. Moreover, the R&D Centres also promote the adoption of local technology products and services through the Public Sector Trial Scheme (“PSTS”). Throughout the years, the R&D Centres have nurtured a lot of research talents and received numerous international awards for their innovations, making significant contribution in consolidating the capabilities of local scientific research teams.

## **WORK OF R&D CENTRES IN 2016-17**

6. The R&D Centres form an important part of our technology infrastructure. Information on the work of the R&D Centres is set out in the ensuing paragraphs and at **Annex A** to **Annex E**.

### **Operating Expenditure**

7. The operating expenditure of the R&D Centres in 2016-17 and their staffing situation (as at end-March 2017) are summarised as follows –

Table 1: Operating Expenditure and Number of Staff

	Operating Expenditure (\$ million)		% change	Number of Staff as at End-March 2017
	2015-16	2016-17		
ASTRI	145.8	144.8	-1%	593
NAMI	54.3	52.7	-3%	216
LSCM	25.1	27.1	+8%	77
HKRITA	29.6	31.4	+6%	47
APAS	15.8	17.7	+12%	29

8. In 2016-17, the operating expenditure(s) of –
- (a) ASTRI and NAMI are largely similar to that of 2015-16;
  - (b) LSCM and HKRITA have increased by 8% and 6% respectively because they have filled some vacant R&D positions; and
  - (c) APAS has increased by 12% mainly because it has upgraded some R&D equipment and filled some vacant R&D positions.

### **Level of Industry Contribution**

9. R&D Centres are platforms for coordinating applied research and facilitating technology transfer to the industry, and as such the level of industry contribution is one of the most important indicators to show the degree of support of the industry in their work.

10. The performance of the R&D Centres in 2016-17 as compared with 2015-16 is summarised as follows –

Table 2: Level of Industry Contribution <sup>(Note)</sup>

	2015-16	2016-17	Difference (Percentage Point)
ASTRI	21.7%	21.3%	-0.4
NAMI	28.9%	38.6%	+9.7
LSCM	23.5%	21.8%	-1.7
HKRITA	34.4%	26.4%	-8.0
APAS	42.5%	21.8%	-20.7

Note : The level of industry contribution is calculated as follows –

$$\frac{\text{Industry Contribution Pledged}}{\text{Approved Project Expenditure}} \times 100\%$$

11. In 2016-17, the performance, in terms of the level of industry contribution, of –

- (a) ASTRI and LSCM are largely similar to that of 2015-16;
- (b) NAMI has improved by 9.7 percentage points since it has initiated a number of market-driven collaborative research projects;
- (c) HKRITA has reported 8 percentage points less because the level of industry contribution was much higher in 2015-16 due to the commencement of two larger-scale projects of over \$10 million each in that year; and
- (d) APAS has dropped by 20.7 percentage points mainly because it has commenced more seed projects<sup>1</sup> in order to build up their research capabilities.

12. In general, we consider the performance of the R&D Centres in 2016-17 satisfactory in this aspect as they all exceeded the target level of industry contribution of 20%.

### **R&D Projects and Expenditure**

13. The numbers of R&D projects of the five Centres in 2016-17 and 2015-16 are summarised below –

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<sup>1</sup> Seed projects are more forward-looking and exploratory projects that aim to provide foundation work for future platform/collaborative projects. No industry contribution is required for seed projects. The funding amount is capped at \$2.8 million per project.

Table 3: No. of New Projects  
and On-going Projects as at end-March 2017

	No. of New Projects Commenced			No. of On-going Projects		
	2015-16	2016-17	% change	As at Mar 2016	As at Mar 2017	% change
ASTRI	42	38	-10%	69	62	-10%
NAMI	45	45	0%	82	86	+5%
LSCM	16	18	+13%	35	37	+6%
HKRITA	21	18	-14%	62	59	-5%
APAS	13	16	+23%	36	44	+22%
<b>Total</b>	<b>137</b>	<b>135</b>	<b>-1%</b>	<b>284</b>	<b>288</b>	<b>+1%</b>

14. In 2016-17 –

- (a) ASTRI has commenced 38 new projects, which has decreased by 10% mainly because some projects can only commence in early 2017-18 due to the revised plan of their industry partners;
- (b) NAMI has commenced 45 new projects, which was the same as 2015-16;
- (c) LSCM has commenced 18 new projects, representing an increase of 13%;
- (d) HKRITA has commenced 18 new projects, which has decreased by 14% since it has dedicated more efforts on cross-discipline projects and projects involving higher level of complexity; and
- (e) APAS has commenced 16 new projects, representing an increase of 23%, because it has initiated more seed projects to build up its research capabilities.

15. Among these projects, many are collaborative projects which require industry contribution of at least 30% of the project cost. The industry sponsor(s) of these projects will be entitled to utilise the intellectual property (“IP”) rights arising from the projects exclusively for a defined period or own the project IP. A summary of these projects is as follows -

Table 4: No. of New Collaborative Projects  
and On-going Collaborative Projects as at end-March 2017

	No. of New Projects Commenced			No. of On-going Projects		
	2015-16	2016-17	% change	As at Mar 2016	As at Mar 2017	% change
ASTRI	4	4	0%	8	7	-13%
NAMI	27	33	+22%	40	51	+28%
LSCM	2	3	+50%	3	4	+33%
HKRITA	5	5	0%	17	15	-12%
APAS	6	3	-50%	15	16	+7%
<b>Total</b>	<b>44</b>	<b>48</b>	<b>+9%</b>	<b>83</b>	<b>93</b>	<b>+12%</b>

16. In 2016-17, the R&D Centres have commenced a total of 48 collaborative projects, representing an increase of 9% compared with 44 projects in 2015-16.

17. As regards R&D expenditure, the situation is as follows –

Table 5: R&D Expenditure (\$ million)

	2015-16	2016-17	% Change
ASTRI	243.7	268.0	+10%
NAMI	63.2	92.4	+46%
LSCM	67.4	83.3	+24%
HKRITA	51.1	41.8	-18%
APAS	54.6	34.2	-37%
<b>Total</b>	<b>480.0</b>	<b>519.7</b>	<b>+8%</b>

18. In 2016-17, the total R&D expenditure of the R&D Centres has increased by 8%. As at end-March 2017, the five R&D Centres had a total of 288 projects still on-going, largely similar to that of 2015-16.

19. Nevertheless, it should be noted that while the figures for a particular year are useful for understanding the work of the R&D Centres,

year-on-year variations are inevitable due to –

- (a) short-term fluctuations in market demand and economic situation which may affect the negotiations/discussions of the R&D Centres with their industry partners/sponsors;
- (b) the need of the R&D Centres to conduct seed projects to build up its research capabilities from time to time; and
- (c) the wish of the R&D Centres to deliver certain public missions, such as the application of their technologies in the public sector, which may affect their short-term income indicators.

### **New Performance Indicators from 2017-18 onwards**

20. During FC's discussion of the additional allocation to the R&D Centres in late 2015, there were suggestions that the Government should set new performance indicators to assess the R&D Centres' performance in conducting R&D in collaboration with the industry in order to promote the latter's overall technological level. In this connection, we briefed Members on the new performance indicators for assessing the performance of the R&D Centres at the Panel meeting on 21 June 2016. One of the indicators is the "level of income received from the industry". The indicator will mainly cover sponsorship from the industry for their R&D projects, income arising from licensing/royalty and contract services, and other income. We plan to set the target for the indicator to 30% from 2017-18 onwards.

21. Furthermore, we will also adopt other performance indicators, such as the number of R&D projects involving industry participation, the number of companies participating in the R&D projects, the number of organisations benefitting from the PSTS, the number of interns engaged, the number of patents filed, etc. From 2018 onwards, we will set out these information in the annual updates on the progress of the R&D Centres.

### **REPORT ON INDIVIDUAL CENTRES**

22. The ensuing paragraphs will highlight the key activities of each R&D Centre.

## ASTRI

23. In 2016-17, ASTRI commenced 38 new projects, comprising 13 platform projects<sup>2</sup>, 4 collaborative projects<sup>3</sup>, 20 seed projects and 1 project under the PSTS. The amount of commercialisation income received increased from \$20.06 million in 2015-16 to \$29.27 million in 2016-17, with an increase of about 46%, demonstrating ASTRI's continual progress in commercialisation and technology transfer.

24. ASTRI has been working closely with the industry on the following areas –

- (a) *Financial Technologies (“FinTech”)*: In 2016-17, ASTRI has made significant progress in the areas of cybersecurity, blockchain, big data and mobile computing. In July 2016, ASTRI established a Cyber Range Laboratory with the Hong Kong Police Force (“HKPF”) for monitoring and simulating online attacks for training purposes. In addition, in collaboration with the Hong Kong Monetary Authority (“HKMA”) and the Hong Kong Association of Banks, ASTRI launched a Cyber Intelligence Sharing Platform in December 2016, which enables timely intelligence sharing to combat cyber-attacks.

A major local bank adopted ASTRI's blockchain technology for faster evaluation of mortgage applications in November 2016 and the Smart Investment Platform for analysing large-scale financial data in January 2017.

ASTRI collaborated with HKMA to establish a FinTech Innovation Hub for trial and demonstration of FinTech solutions in November 2016, and launch a FinTech Career Accelerator Scheme in December 2016, through which banks and HKMA would offer FinTech-related internships for university students.

- (b) *Intelligent Manufacturing*: ASTRI has focused its R&D in the areas of intelligent energy and power electronics, robotic vision,

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<sup>2</sup> The industry contribution of platform projects should be at least 10% of the project cost. The industry sponsor(s) will not own the project IP. Since February 2014, the industry contribution requirement for projects initiated by Government bureaux/departments and/or statutory bodies with clear community benefits has been waived.

<sup>3</sup> The industry contribution of collaborative projects should be at least 30% (for R&D Centre projects only) or 50% (for non-R&D Centre projects) of the project cost. The industry sponsor(s) will be entitled to utilise the project IP exclusively for a defined period or own the project IP.



cyber-physical systems and environment Internet-of-Things (“IoT”) sensing. ASTRI has collaborated with top manufacturing enterprises for the development of a software system for enabling reconfigurable and highly automated manufacturing processes and a touch panel glass defect inspection machine which won the 2016 Hong Kong Awards for Industries. ASTRI has also licensed its three-dimensional robotic vision technology to a manufacturing company for enhancing real-time manufacturing process;

- (c) *Next Generation Network:* ASTRI has been actively developing and commercialising different advanced 4G+/5G technologies, supporting its industry partners to commercially deploy licensed 4G+ private end-to-end networks and enhancing the Wireless Innovation Platform to support the next generation wireless and application technologies. For example, ASTRI has deployed its commercial-grade advanced wireless system in the train control signaling network system of the Wuhan Metro Line 6, which commenced operation in December 2016;
- (d) *Health Technology:* ASTRI has continued its R&D on medical imaging and health monitoring devices. Big data analytics and deep learning technologies were leveraged to enhance diagnosis in pathology imaging and endoscopy applications. In addition, its miniaturised blood pulse oximeter technology was commercialised and a smart watch product was developed and launched for the market in 2016; and
- (e) *Smart City:* ASTRI has been developing technologies for the smart city initiative, including a broadband smart meter system-on-chip for power line data transmission, which facilitates the monitoring and billing of electricity consumption. ASTRI is also commercialising its Heads-Up-Display technology which enhances driving safety and control through see-through virtual display. IoT software systems for smart indoor and outdoor Geographic Information System have been developed and trials will be conducted in Kowloon East. ASTRI is collaborating with the Hong Kong Science and Technology Parks Corporation in establishing a Smart City Innovation Centre to facilitate smart city development in Hong Kong.

25. Furthermore, in 2016-17, ASTRI also established joint R&D centres and laboratories with major industrial partners and local universities

(including the University of Hong Kong, the Chinese University of Hong Kong and the Hong Kong University of Science and Technology), for talent development and R&D in FinTech, smart manufacturing and next generation network.

## **NAMI**

26. In 2016-17, NAMI commenced 45 new projects, comprising 6 platform projects, 33 collaborative projects, 4 seed projects and 2 projects under the PSTS. The number of new collaborative projects commenced increased from 27 in 2015-16 to 33 in 2016-17. The amount of industry income received increased from \$31.58 million in 2015-16 to \$56.82 million in 2016-17, with an increase of about 80%, demonstrating NAMI's continual progress in commercialisation and technology transfer.

27. NAMI will continue to build on its core platform technologies including nanofiber, functional plastics, flexible battery, power battery, nano-coating, nano-bubble, super concrete and nano-capsule, turning cutting-edge technologies into products.

28. NAMI has developed a number of technologies which won various international awards in 2016-17. For example, NAMI was awarded nine gold medals (four awarded with Jury Commendation), one silver medal, as well as three special awards at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.

29. Some of the Centre's R&D work in 2016-17 include –

- (a) *Ultra-flexible and Super Safe Battery Technology for Wearable Electronics:* NAMI has developed lithium ion batteries using nanofiber sponge electrolyte which is highly flexible, super-safe, powerful and rechargeable. The flexible battery has been integrated into a smart watch as a detachable watch strap with improved battery capacity and operation time. The technology has become a platform technology for local industries to develop different wearable products such as batteries for smart gadgets. This technology was awarded the Technological Achievement Award at the 2016 Hong Kong Awards for Industries;
- (b) *Breathable Nanofiber PM2.5 Facemask for Sports:* Combining the desirable features of both surgical mask and N95 respirator, the nanofiber facemask for sports offers protection by effectively

filtering PM2.5, bacteria and viruses while allowing free flow of air. It is ideal for use in sports activities, offering user protection against airborne infection and comfort. Another bacteria-killing protective mask from a collaborative project has been successfully commercialised and is available for sale in local pharmacies;

- (c) *A New Eggshell Recycling Technology for Turning Garbage to Treasure:* The eggshell recycling technology can recycle the whole eggshell by a one-step reaction, extracting 99% of the valuable nutrients such as collagen and elastin instantly, and speed up the extraction process; and
- (d) *Battery to Power Electronic Devices under Extreme Temperature:* The rechargeable lithium-ion battery possesses large pulse discharge capability under extreme temperature from -40°C to 85°C. It offers an ideal energy storage solution for operating all-weather and remote smart devices. The industry partner has successfully launched the products to the market, covering electronic toll collection, automatic water meter, etc.

30. Furthermore, NAMI has developed nano cementitious waterproofing materials, a coating which offers superior elongation and waterproof performance with multiple applications for rooftops, toilets and tanks. In June 2016, its industry partner set up a production line in Hong Kong.

## **LSCM**

31. In 2016-17, LSCM commenced 18 new projects, comprising 6 platform projects, 3 collaborative projects, 4 seed projects and 5 projects under the PSTS. The amount of industry income received increased over 40% from \$7.87 million in 2015-16 to \$11.36 million in 2016-17, signifying LSCM's growing support from the industry.

32. Some examples of the Centre's work on enabling research and commercial adoption in 2016-17 include –

- (a) *Smart Airport Initiative:* In collaboration with the Airport Authority Hong Kong, LSCM has developed a barcode and radio-frequency identification ("RFID") scanner, which allows passengers to print luggage tags at home and self-check-in luggage, thereby reducing waiting time at the check-in counter. The

system has already been adopted by 31 airlines including a local major airline.

LSCM has further developed a robotic label affixing system to reduce reliance on manual labour for the RFID label-affixing processes. The robot-arm-based automated system can pick and place labels on luggage of various shape, size and material. The system is currently under trial at the Hong Kong International Airport (“HKIA”);

- (b) *E-commerce Industry:* In collaboration with the Hongkong Post, LSCM has developed an RFID-enabled parcel locker system which allows convenient parcel collection at territory-wide iPostal Stations outside office hours. The system also enables the Hongkong Post to obtain real time information on the availability of individual lockers. This innovation won a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017;
- (c) *Smart Community Services:* LSCM has collaborated with the Hong Kong Society for the Blind and developed several smart community applications for the visually impaired, which would help them navigate both indoor and outdoor more easily. These application systems have been adopted in a home for the aged blind and a social enterprise is currently promoting the application systems to three local shopping malls;
- (d) *Air Cargo Industry:* In collaboration with one of the major air cargo terminals, LSCM has developed a Virtual Reality Training System derived from a three-dimensional model of a commercial freight aircraft. With this training platform, the air freight industry can now provide a more cost effective and efficient training program;
- (e) *E-Warehouse Automation:* LSCM has developed a fully autonomous robotic moving-rack storage system. As local warehouses tend to operate in a dense environment, this system provides an inexpensive automated solution for companies to meet the rising demand in e-commerce logistics. Five licenses from this project have been granted to two local companies in March 2017 for further commercialising this technology; and

- (f) *Cybersecurity for e-Logistics and e-Commerce Infrastructure:* In collaboration with HKPF and HKMA, LSCM has developed the Smart Hacking and Intrusion Entrapment with Lawful Detection (“SHIELD”) system. This system protects enterprises from cyber-attacks, such as distributed denial-of-service attack and its related black-mailing. LSCM is currently conducting a trial of the SHIELD system in Cyberport’s Smart-Space FinTech.

33. In addition, LSCM is collaborating with the Chinese University of Hong Kong to develop smart drainage monitoring using IoT technologies. To support the Government’s Smart City initiative, LSCM will develop more applications such as indoor/outdoor positioning and navigation, as well as three-dimensional mapping of Hong Kong’s landscape.

## **HKRITA**

34. In 2016-17, HKRITA commenced 18 new projects, comprising 10 platform projects, 5 collaborative projects, 1 seed project and 2 projects under the PSTS. The industry income received has increased from \$5.76M in 2015-16 to \$18.53M in 2016-17, with an increase of over 220%, demonstrating its growing support from the industry and progress in commercialisation and technology transfer.

35. HKRITA has continued to collaborate with local research institutes to develop new materials and advanced production technologies, as well as to conduct more multi-discipline and industry-driven research projects.

36. In 2016-17, HKRITA has focused on the R&D work of textile recycling and high-performance textile. Two examples of the Centre’s R&D work include –

- (a) *Recycling of Used Apparel into Fiber:* A safe and dry closed system is being developed to effectively reproduce sanitised fiber from used apparel, which will contribute to the textile waste reduction and re-industrialisation in Hong Kong; and
- (b) *Enhanced Polymerisation Process and Polymeric Materials for Smart Manufacturing:* Under a four-year global collaboration agreement on innovative industrial solutions between HKRITA and a renowned international fashion brand, an advanced polymerisation process is being developed to enhance the fundamental properties of polymeric materials and facilitate the melt spinning process.

37. HKRITA has developed a number of technologies which won various international awards in 2016-17. HKRITA was awarded three gold medals, four silver medals and two special awards at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017. Among the gold medals, two technologies (on “new functional textiles from bio-based and degradable fibers” and “development of fine worsted yak yarns and fabrics”) were awarded with Jury Commendation. Another commercialised technology, the “fabric touch tester”, which can objectively assess hand feel using a formula derived from fabric properties, also won a Grand Award of Equipment and Machinery Design at the 2016 Hong Kong Awards for Industries.

38. HKRITA has continued to promote the adoption of R&D outcomes in the public sector. HKRITA has commenced a few projects in collaboration with the Hong Kong Sports Institute to facilitate elite athletes in their preparation for the 2018 Asian Games and 2020 Olympic Games. One of the projects is to design high performance wheelchair cushions to protect the boccia athletes.

39. In 2016-17, HKRITA has dedicated its efforts on commercialisation, transferring its technologies to the industry. HKRITA signed eight licensing agreements with our industry during the year. HKRITA has also disseminated the carbon footprint modeling for manufacturing process to 21 companies through collaboration with the Clothing Industry Training Authority, and offered innovative materials from eight novel technologies to 11 emerging Hong Kong fashion designers at a PMQ fashion event.

## **APAS**

40. In 2016-17, APAS commenced 16 new projects, comprising 1 platform project, 3 collaborative projects, 8 seed projects and 4 projects under the PSTS. The total number of new projects commenced has increased from 13 in 2015-16 to 16 in 2016-17.

41. During the year, APAS has focused on building up its in-house research capability in automotive energy saving and safety technology. These in-house research projects will provide the necessary foundation for future collaborative projects.

42. In recent years, APAS has put a stronger emphasis on commercialising R&D results and transferring technologies to the industry. Some examples are as follows –

- (a) *Multi-standard Mobilised Smart Charger for Electric Vehicles (“EVs”)*: To address the issue of insufficient fast charging stations for EVs, APAS has developed a mobilised smart charger for EVs, which offers highly flexible and fast charging solutions where EV charging stations are not available. APAS will conduct a trial project with the Hong Kong Automobile Association to explore the market potential; and
- (b) *Bus Infotainment System*: APAS has developed the second generation of the Bus Infotainment System. With the first generation of the system already installed in more than 80 buses across Hong Kong and Guangdong, the industry partner has started to install the second generation of the system on 400 cross-border buses in three years.

43. Following the technology trend of the industry, APAS is developing a medium wireless EV charger with magnetic flux leakage protection to ensure safe operation. APAS is also developing a Smart Vehicle-to-Home system for convenient energy transfer between smart vehicle and the household.

44. APAS has been utilising the PSTS to apply its R&D outcomes in the community. For example, APAS’s Dual Channel Fast Charging Station for EVs has been under trial at HKIA, Water Supplies Department, HKPF and Hong Kong Housing Society, which have provided positive feedback on the installations.

## **ADVICE SOUGHT**

45. Members are invited to note the latest progress of the R&D Centres.

**Hong Kong Applied Science and Technology Research Institute (“ASTRI”)  
Highlight of Operation in 2016-17**

**I. New R&D Projects and Industry Contribution (in \$million)**

	<u>2015-16</u>			<u>2016-17</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	14	239.1	49.7 (24.3%)	13	196.7	42.8 (21.8%)
Collaborative	4	27.5	14.1 (51.2%)	4	36.4	18.3 (50.2%)
Seed	23	61.5	n/a	20	53.9	n/a
Total:	41	328.1	63.8 (21.7%)	37	287.0	61.1 (21.3%)
Public Sector Trial Scheme	1	6.1	n/a	1	5.4	n/a

*Note: Figures in brackets denote the level of industry contribution.*

**II. Operating Expenditure (in \$million)**

	2015-16	2016-17
Staffing	73.6	77.6
Accommodation	30.2	24.0
Equipment	3.9	3.1
Others	38.1	40.1
Total:	145.8	144.8

**III. Industry Income Received (in \$million)**

	2015-16	2016-17
Sponsorship for projects	61.37	48.73
Licensing/Royalty	2.99	4.20
Contract Services	16.69	24.67
Others	0.38	0.40
Total:	81.43	78.00



#### IV. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p><b>Establishment of BOCHK-ASTRI FinTech Collaboration Centre</b></p> 	<p>ASTRI has been working closely with the financial sector to foster the development of financial technologies (“FinTech”) in Hong Kong. In July 2016, ASTRI and the Bank of China (Hong Kong) Limited (“BOCHK”) jointly established the BOCHK-ASTRI FinTech Collaboration Centre with the view to developing the latest FinTech for application in the banking industry.</p>
<p><b>Property Valuation Blockchain Application by BOCHK</b></p> 	<p>ASTRI has also worked with BOCHK to introduce blockchain technology for evaluating property mortgage applications. The application was officially launched by BOCHK in November 2016 for a faster and more user-friendly property valuation process.</p>
<p><b>Smart Investment Platform</b></p> 	<p>Co-developed by ASTRI and an industry partner, the Smart Investment Platform was adopted by BOCHK for a Smart Investment Contest jointly organised with ASTRI in January 2017. Contestants could use the platform, which offers investment proposals by analysing large-scale financial data, to formulate their investment strategies.</p>
<p><b>Cyber Security Research and Practice Platform and Cyber Range Laboratory</b></p> 	<p>ASTRI has developed a cybersecurity research and practice platform for investigating cybercrimes, researching on cybersecurity solutions and training of cybersecurity professionals.</p> <p>In July 2016, ASTRI established a Cyber Range Laboratory with the Hong Kong Police Force for monitoring and simulating online attacks, and providing state-of-the-art training to cybersecurity practitioners in law enforcement agencies and financial institutions.</p>

Project / Technology	Status / Progress
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**Establishment of HKMA-ASTRI FinTech Innovation Hub**





ASTRI and the Hong Kong Monetary Authority (“HKMA”) jointly established the HKMA-ASTRI FinTech Innovation Hub in November 2016. The Hub provides a neutral ground for industry players such as banks, payment service providers, and FinTech start-ups to test and evaluate different FinTech solutions and concepts before rolling out to the market. Some proof-of-concept projects such as optical character recognition, distributed ledger technology (“DLT”) and soft token authentication have been conducted at the Hub.



ASTRI has also conducted a comprehensive study on DLT for HKMA and published a white paper on the initial findings on DLT in November 2016. With these findings, ASTRI has recently developed a few proof-of-concept applications with HKMA, banks and other financial institutions that could benefit from the DLT. The property valuation blockchain application adopted by BOCHK above is DLT-based. Other applications such as trade finance and digital identity are being explored for potential deployment.

**Establishment of HSBC-ASTRI Research and Development Innovation Laboratory**



The Hongkong and Shanghai Banking Corporation Limited (“HSBC”) and ASTRI jointly established the HSBC-ASTRI Research and Development Innovation Laboratory (“RDI Lab”) in October 2016.

The RDI Lab seeks to apply ASTRI’s latest technologies to address domain specific requirements of HSBC’s businesses so as to enhance their productivity and security. One application area is artificial intelligence on handwritten Chinese character recognition which can enhance the efficiency of manual form processing tasks.

Project / Technology	Status / Progress
<p data-bbox="215 271 751 338"><b>Time Divisional-Long-Term-Evolution (“TD-LTE”) Technologies</b></p> 	<p data-bbox="810 271 1417 483">ASTRI has developed a commercial-grade advanced wireless system (TD-LTE technologies) for the train control signaling network system of the Wuhan Metro Line 6, which commenced operation in December 2016.</p> <p data-bbox="810 544 1417 797">The design of the train control signaling network system can be optimised for real time monitoring purposes, which can reduce signal interference and shorten signal communication between the control centre and trains, thereby enhancing the safety, reliability and efficiency of subway operation.</p>
<p data-bbox="215 857 687 891"><b>Automatic Meter Reading System</b></p> 	<p data-bbox="810 857 1417 1003">ASTRI has built a core complex event computation platform with features such as high performance data processing and event modelling.</p> <p data-bbox="810 1059 1417 1272">The platform can be applied in various areas. For example, ASTRI has applied this technology to develop an Automatic Meter Reading System, which monitors water systems, resolves water leakage problem and improves operational efficiency.</p> <p data-bbox="810 1328 1417 1395">The system won the Hong Kong ICT Awards 2017: Best Business Solution Bronze Award.</p>

Project / Technology	Status / Progress
<p data-bbox="215 264 770 302"><b>Intelligent Visual Inspection Technology</b></p>  	<p data-bbox="810 264 1417 488">ASTRI has developed an intelligent surface defects inspection technology platform for surfaces of different characteristics. Through automation, manufacturers can save manpower resources in checking the product quality and appearance.</p> <p data-bbox="810 539 1417 797">Trial run results of the first prototype of the defects inspection technology platform have demonstrated that many kinds of defects (e.g., scratch, spot defects, edge crack, etc.) can be successfully detected. The technology has been licensed to a local manufacturing company.</p> <p data-bbox="810 848 1417 1140">The Cover Glass and Touch Panel Glass Automatic Defects Inspection System won the 2016 Hong Kong Awards for Industries in the Equipment and Machinery Design category. The technology was presented at the APAC Innovation Summit 2016 and showcased at the Industrial Automation Shenzhen 2016.</p>
<p data-bbox="215 1202 758 1240"><b>Three-dimensional Imaging technology</b></p>  	<p data-bbox="810 1202 1417 1348">ASTRI has successfully developed three-dimensional conversion technologies to generate contents for different kinds of spectacles-free three-dimensional displays.</p> <p data-bbox="810 1400 1417 1691">In 2016, ASTRI established a joint innovation centre with a local electronics strategic partner for further development in multi-media technology. The center focuses on developing three-dimensional technology for enhancing TV-quality movies and TV series, and converting content for TV programmes.</p> <p data-bbox="810 1742 1417 1888">This multi-media technology can be applied in multiple areas, including the retail and broadcast industry, to bring extraordinary visual experience to audience.</p>

**Nano and Advanced Materials Institute (“NAMIP”)  
Highlight of Operation in 2016-17**

**I. New R&D Projects and Industry Contribution (in \$million)**

	<u>2015-16</u>			<u>2016-17</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	6	21.3	2.1 (10.0%)	6	29.3	5.7 (19.4%)
Collaborative	27	60.6	28.6 (47.2%)	33	83.1	42.0 (50.5%)
Seed	9	24.3	n/a	4	11.1	n/a
Total:	42	106.2	30.7 (28.9%)	43	123.5	47.7 (38.6%)
Public Sector Trial Scheme	3	4.7	n/a	2	1.7	n/a

*Note: Figures in brackets denote the level of industry contribution.*

**II. Operating Expenditure (in \$million)**

	2015-16	2016-17
Staffing	29.5	30.3
Accommodation	7.9	5.9
Equipment	6.4	7.2
Others	10.5	9.3
Total:	54.3	52.7



**III. Industry Income Received (in \$million)**

	2015-16	2016-17
Sponsorship for projects	25.63	40.86
Licensing/Royalties	0.69	1.89
Contract Services	5.07	13.56
Others	0.19	0.51
Total:	31.58	56.82

#### IV. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p data-bbox="204 367 788 439"><b>Ultra-flexible and Super Safe Battery Technology for Wearable Electronics</b></p> 	<p data-bbox="810 367 1398 658">NAMI has developed lithium ion batteries using nanofiber sponge electrolyte which is highly flexible, super-safe, powerful and rechargeable. In collaboration with an industry partner, NAMI has integrated this flexible battery into a smart watch as a detachable watch strap with improved battery capacity and operation time.</p> <p data-bbox="810 712 1398 819">The technology has also been applied to develop different innovative wearable products such as batteries for smart gadgets.</p> <p data-bbox="810 873 1398 1128">The technology was awarded a gold medal, the Prize of the Chinese Delegation for Invention and Innovation, and a special award for the Invention by Romanian Association for Nonconventional Technologies at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p> <p data-bbox="810 1182 1398 1290">The technology was also awarded the Technological Achievement Award at the 2016 Hong Kong Awards for Industries.</p>
<p data-bbox="204 1359 619 1391"><b>Germ-repellent Plastic Resins</b></p> 	<p data-bbox="810 1359 1398 1686">NAMI, in collaboration with an industry partner, has developed germ-repellent plastic resins which can achieve antimicrobial function without the use of biocides, which could potentially be hazardous to health. The material is also friendly to beneficial bacteria and fits into current manufacturing processes such as injection moulding.</p> <p data-bbox="810 1740 1398 1848">This technology has been further developed in the improvement of food grade and medical grade plastic products.</p> <p data-bbox="810 1901 1398 2009">The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>

Project / Technology	Status / Progress
<p data-bbox="204 259 788 327"><b>Breathable Nanofiber PM2.5 Facemask for Sports</b></p> 	<p data-bbox="810 259 1390 439">NAMI, in collaboration with an industry partner, has developed a facemask with high breathability, yet offering strong protection from PM2.5. This is particularly suitable for use in sports activities.</p> <p data-bbox="810 495 1390 741">NAMI has also collaborated with the industry partner in another project on bacteria-killing and viruses-trapping protective masks which have been successfully commercialised and are now available for sale in local pharmacies and chain stores.</p> <p data-bbox="810 797 1390 909">The technology was awarded a gold medal at the 45th International Exhibition of Inventions of Geneva 2017.</p>
<p data-bbox="204 1088 735 1122"><b>A New Eggshell Recycling Technology</b></p> 	<p data-bbox="810 1088 1390 1346">In collaboration with an industry partner, NAMI has developed an eggshell recycling technology, which can recycle the whole eggshell by a one-step reaction, extracting 99% of the valuable nutrients such as collagen and elastin instantly, and speed up the extraction process.</p> <p data-bbox="810 1402 1390 1547">This project is expected to be completed in the second half of 2017. The industry partner has planned to commercialise this new recycling technology.</p> <p data-bbox="810 1603 1390 1738">The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017, and a Polish Academy of Science Award Certificate.</p>

Project / Technology	Status / Progress
<p data-bbox="204 259 639 293"><b>Innovative Capsule Technology</b></p> 	<p data-bbox="810 259 1398 439">NAMI has co-developed with an industry partner a capsule technology which enables the production of super strong lightweight concrete. It also offers superior thermal and acoustic insulation.</p> <p data-bbox="810 495 1398 786">NAMI is working closely with the Hong Kong Housing Authority on the trial use of the technology. Two mock-up flats have been built, one using NAMI's lightweight concrete while the other using normal concrete. The trial has demonstrated that at least 50% of electricity can be saved for the flat built with NAMI's lightweight concrete.</p> <p data-bbox="810 842 1398 943">The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>
<p data-bbox="204 1014 788 1081"><b>Battery to Power Electronic Devices under Extreme Temperature</b></p> 	<p data-bbox="810 1014 1398 1234">NAMI, in collaboration with an industry partner, has developed an extreme-temperature battery, which is an energy storage solution for all-weather and remote smart applications under extreme temperatures from -40°C to 85°C.</p> <p data-bbox="810 1290 1398 1536">This technology has been scaled up in a new product line and launched to the market covering electronic toll collection, automatic water meter, and automatic lock for bicycle sharing business. The industry sponsor has successfully sold over 100 000 units so far, and the demand is growing.</p> <p data-bbox="810 1592 1398 1693">The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>



Project / Technology	Status / Progress
<p><b>Nano Bubble Technology</b></p> 	<p>NAMI has developed a nanobubble technology, which can create over 40 million nanobubbles in one millilitre of water by a small fixture of nanobubble generator. It can provide highly efficient gas dissolution and stable oxidising for application in a variety of areas.</p> <p>The industry partner will use this technology for developing sanitation systems for fountain water, swimming pool water and water cooling towers. The industry partner has identified a fountain for trial purpose.</p> <p>The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>
<p><b>Nano Cementitious Waterproofing Materials</b></p> 	<p>NAMI has developed a new technology for dispersing nanoparticles uniformly over polymer cementitious coating which could enhance its elongation and adhesion properties, thereby achieving high flexibility and waterproof performance. The coating can be applied on rooftops, toilets, external walls, tanks, etc.</p> <p>The industry sponsor has set up a production line in Hong Kong for the coating. The coating has been applied to over 6 000 square metres of site area with positive user feedback.</p> <p>The technology was awarded a silver medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>
<p><b>Novel Nanoparticles for Pre-clinical Diagnosis for Early Alzheimer Detection and Drug Development</b></p> 	<p>NAMI, together with an industry partner, is developing a novel technology for early detection of Alzheimer's Disease ("AD") and speeding up the AD drug screening cycle. The industry partner has started the product and production design.</p> <p>The technology was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>

**Hong Kong R&D Centre for  
Logistics and Supply Chain Management Enabling Technologies (“LSCM”)  
Highlight of Operation in 2016-17**

**I. New R&D Projects and Industry Contribution (in \$million)**

	<u>2015-16</u>			<u>2016-17</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	6	48.4	7.6 (22.1%)	6	47.8	11.1 (23.2%)
Collaborative	2	3.2	1.6 (51.6%)	3	5.2	2.7 (51.9%)
Seed	2	5.7	1.0 (16.8%)	4	10.4	0 (0%)
Total:	10	57.3	10.2 (23.5%)	13	63.4	13.8 (21.8%)
Public Sector Trial Scheme	6	21.7	n/a	5	14.7	n/a

*Note: Figures in brackets denote the level of industry contribution.*




**II. Operating Expenditure (in \$million)**

	2015-16	2016-17
Staffing	14.5	16.0
Accommodation	4.9	4.9
Equipment	0.8	0.7
Others	4.9	5.5
Total:	25.1	27.1

**III. Industry Income Received (in \$million)**

	2015-16	2016-17
Sponsorship for projects	7.44	10.39
Licensing/Royalty	0.40	0.37
Contract Services	0.03	0.60
Others	-	-
Total:	7.87	11.36

#### IV. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p data-bbox="215 421 805 548"><b>Hybrid Reader for Home Printed Luggage Tags Service and Universal Robotic Label Affixing System</b></p>  	<p data-bbox="845 421 1396 604">In collaboration with the Airport Authority Hong Kong, LSCM has developed a barcode and radio-frequency identification (“RFID”) hybrid scanner for the provision of home-printed luggage tag service.</p> <p data-bbox="845 660 1396 985">Together with the reusable RFID baggage tags, passengers will be able to print their luggage tags at home and self-check-in luggage in advance. This will enhance passenger experience by reducing waiting time at the check-in counter. 31 airlines, including a local major airline, have adopted this technology at their self-check-in counters.</p> <p data-bbox="845 1041 1396 1332">In addition, LSCM has developed a universal robotic label affixing system for the airport luggage system. This automated system can pick and place labels on luggage of various shape, size and material. The system is currently under trial at the Hong Kong International Airport (“HKIA”).</p>
<p data-bbox="215 1456 742 1534"><b>iPostal Station – RFID-enabled Parcel Locker System</b></p> 	<p data-bbox="845 1456 1396 1713">In collaboration with the Hongkong Post, LSCM has developed an RFID-enabled parcel locker system for integration with the iPostal Stations. This innovative service has provided a new and convenient solution for customers to collect their parcels.</p> <p data-bbox="845 1769 1396 2094">The RFID system allows the Hongkong Post to obtain real time information on locker availability and parcel pick-up status so as to cope with the rising demand from e-commerce logistics. The system has been implemented in selected iPostal Stations. The project was awarded a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>

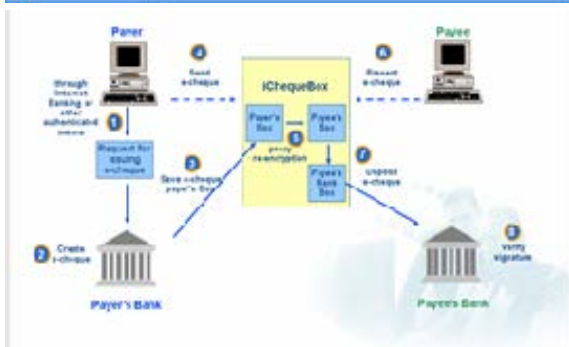
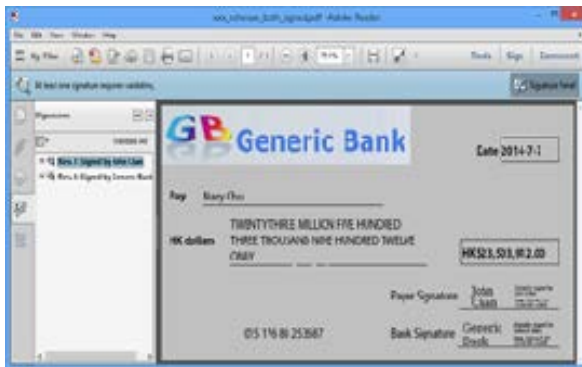
Project / Technology	Status / Progress
<p data-bbox="215 293 799 398"><b>e-Warehouse Automation - Automated Guided Vehicle (“AGV”) Technologies for Industrial Applications</b></p>  	<p data-bbox="842 293 1404 472">LSCM has developed a fully autonomous robotic moving-rack storage system, the AGV, and intelligent scheduling applications for local small and medium enterprises (“SMEs”).</p> <p data-bbox="842 528 1404 887">This low cost AGV is specially designed to tackle problems encountered by local warehouse and logistics SMEs that tend to operate in a very dense environment. Overall efficiency will be enhanced as the system is fully automated and can work around the clock. The AGV has integrated a low cost safety sensor for a safe human-robot collaborative environment.</p> <p data-bbox="842 943 1404 1122">In 2017, technology licenses from this project were granted to two local system integrators and technology providers which provide turnkey solutions to local, Mainland and overseas customers.</p>
<p data-bbox="215 1234 799 1308"><b>Virtual Reality (“VR”) training system for Air Cargo Logistics Operations</b></p>  	<p data-bbox="842 1234 1404 1451">LSCM has worked with the University of Hong Kong and a major air cargo terminal to design and construct a tailor-made VR training system at a training center of the HKIA for the operation of loading and unloading cargo to and from an aircraft.</p> <p data-bbox="842 1507 1404 1720">The training system was designed through a three-dimensional model of a freight aircraft. VR training is highly cost effective and can minimise risk of injury and damage to equipment as compared with conventional methods.</p> <p data-bbox="842 1776 1404 1921">LSCM is working with various government departments and private companies to set up VR training platforms to exploit the commercialisation potential of the project.</p>

Project / Technology	Status / Progress
<p data-bbox="215 286 815 358"><b>Smart Cane - RFID-enabled Navigation for Visually-impaired</b></p>  	<p data-bbox="837 286 1410 544">In collaboration with the Hong Kong Society for the Blind (“HKSB”), LSCM has developed several smart community applications for the visually impaired, such as the Smart Cane, wearable reader, mobile app and RFID-enabled service logging device.</p> <p data-bbox="837 600 1410 813">With the RFID-tagged tiles, smart cane and mobile app, audible navigation information will be provided such that the visually impaired can navigate both indoor and outdoor and identify objects needed for their daily use more easily.</p> <p data-bbox="837 869 1410 1160">These application systems have been implemented in a home for the aged blind. Further trials will be conducted at railway stations to provide navigation in an open environment. A social enterprise, a subsidiary of HKSB, is currently promoting the application systems to three local shopping malls.</p>
<p data-bbox="215 1189 783 1317"><b>Smart Hacking and Intrusion Entrapment with Lawful Detection (“SHIELD”) System</b></p>  	<p data-bbox="837 1189 1410 1368">LSCM has collaborated with the Hong Kong Police Force (“HKPF”) and developed the Smart Hacking and Intrusion Entrapment with Lawful Detection (“SHIELD”) system.</p> <p data-bbox="837 1424 1410 1861">The SHIELD system will allow the HKPF and the industry to receive cyber-attack alerts and make timely incident response when these cyber-attacks occur. The technology developed could help all related key stakeholders to be better prepared for potential cyber-attacks, such as distributed denial-of-service attack and its related black-mailing, and improve their response time. SIELD provides an inexpensive information security platform for e-commerce companies.</p> <p data-bbox="837 1917 1410 2029">LSCM is currently conducting a trial of the SHIELD system in Cyberport’s Smart-Space FinTech.</p>

**Project / Technology**

**Status / Progress**

**e-Cheque Wallet Application**



Working with the HKMA, LSCM has implemented an e-Cheque wallet application, which allows e-Cheque to be stored and transferred between wallets via email or cloud-based servers. Transfers of e-Cheque are recorded using blockchain technology, which tracks time, source and destination uniquely.

This technology provides traceability, thereby enhancing the security feature of the e-Cheque and public confidence in this innovative payment instrument.

This application was awarded a silver medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.

**Baby-Tag with RFID Technology**



LSCM has developed a tamper-resistant strap lock and a control system with RFID tags (“Baby-Tag”) for baby monitoring and incident reporting.

The Baby-Tag technologies have been successfully commercialised and were adopted by a local private hospital.

LSCM has also licensed the technologies to two local system integrators. One of them has collaborated with the hospital in providing infant monitoring services at the obstetrics ward.

**Hong Kong Research Institute of Textiles and Apparel (“HKRITA”)  
Highlight of Operation in 2016-17**

**I. New R&D Projects and Industry Contribution (in \$million)**

	<u>2015-16</u>			<u>2016-17</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	8	30.4	8.3 (27.5%)	10	45.8	7.8 (17.1%)
Collaborative	5	24.1	12.3 (51.0%)	5	20.1	10.3 (51.0%)
Seed	2	5.6	n/a	1	2.7	n/a
Total:	15	60.1	20.6 (34.4%)	16	68.6	18.1 (26.4%)
Public Sector Trial Scheme	6	6.8	n/a	2	2.7	n/a

*Note: Figures in brackets denote the level of industry contribution.*

**II. Operating Expenditure (in \$million)**


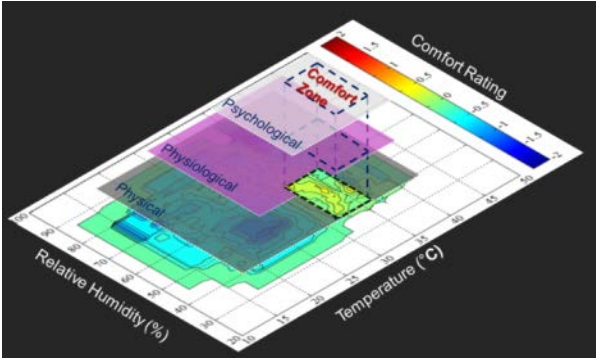

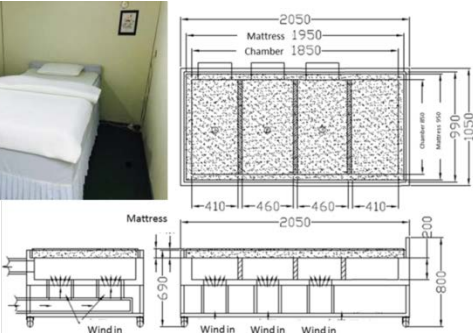
	2015-16	2016-17
Staffing	16.9	18.6
Accommodation	3.0	3.9
Equipment	3.5	2.1
Others	6.2	6.8
Total:	29.6	31.4

**III. Industry Income Received (in \$million)**

	2015-16	2016-17
Sponsorship for projects	4.63#	17.52#
Licensing/Royalty	0.40	0.32
Contract Services	0.09	0.25
Others	0.64	0.44
Total:	5.76	18.53


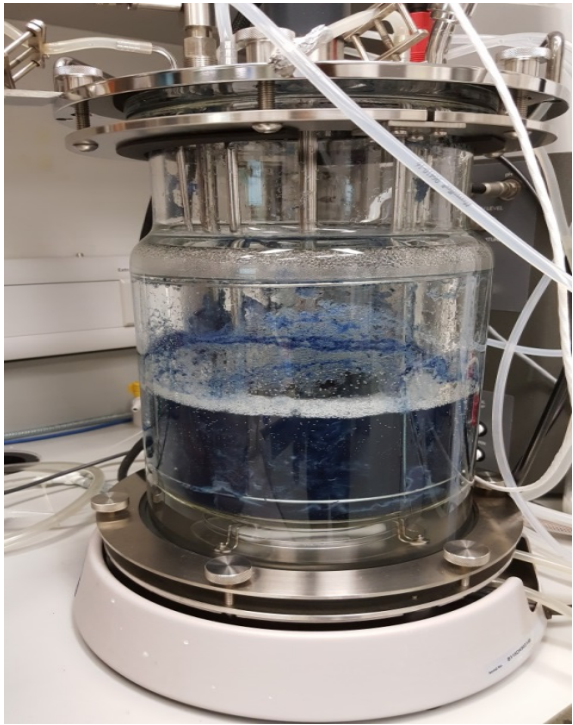
# Excluded sponsorship directly collected by local research institutions from sponsors.

#### IV. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector

Project / Technology	Status / Progress
<p><b>Development of An Innovative Spinning System for Chitosan Yarn</b></p> 	<p>HKRITA has applied static and antistatic theories on the blending and spinning technologies to develop an innovative spinning process for chitosan yarn, which has antibacterial properties. The system can help manufacturers of chitosan yarns enhance productivity and save cost.</p> <p>HKRITA will conduct a trial of the system by producing a series of handkerchiefs, aprons and bedding made by chitosan yarn for 100 elderlies in an elderly home under the Tung Wah Group of Hospitals. The technology has also been licensed to two industry partners.</p> <p>This technology won a gold medal at the 44<sup>th</sup> International Exhibition of Inventions of Geneva 2016.</p>
<p><b>Development of Sleeping Thermal Comfort Assessment System for Textile Products</b></p>   	<p>In collaboration with Shinshu University Japan, HKRITA has developed a system to objectively assess the sleeping comfort of an environment, which can facilitate the development of sleepwear and bedding textiles.</p> <p>The system includes a controllable bed-cover microclimate device and a sleeping comfort assessment system. It provides a stable and controllable environment for gauging human physiological and psychological responses, making it possible to collect reliable data and perform comfort assessment.</p> <p>A non-exclusive licence was granted to a company for this technology.</p> <p>This technology won a gold medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>



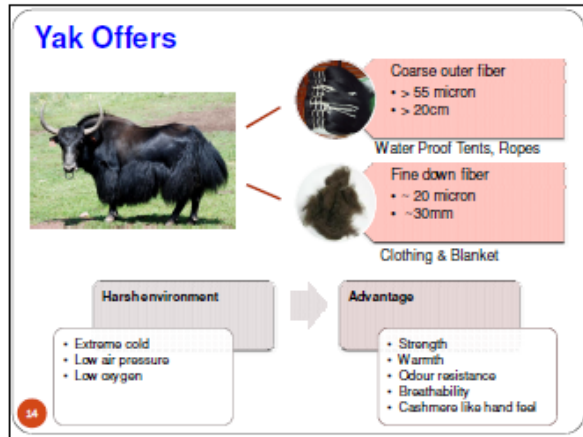
Project / Technology	Status / Progress
<p><b>Enhanced Manufacturing Technology for Green Textiles</b></p>  	<p>HKRITA has extended the manufacturing technology for bio-based and eco-friendly polymers/fibres to produce “green” textiles. The technology is enhanced to –</p> <ul style="list-style-type: none"> <li>(a) develop new spinning, knitting, dyeing, and finishing processes to manufacture a series of top-grade silk-like “green” knitting;</li> <li>(b) develop bio-based medical compression stockings for treating varicose vein; and</li> <li>(c) develop a fabrication technique of degradable biomaterials with complex textile structures.</li> </ul> <p>This technology won a gold medal with Jury Commendation and a special award by the Scientific Community of Romania at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>
<p><b>Asymmetric Competition Footwear for Hong Kong Olympic Fencing Team</b></p>  	<p>HKRITA has designed and developed asymmetric footwear with cushions/inserts according to the biomechanical characteristics of fencing.</p> <p>The shoes provide feet support according to different motions of the lunge, offering enhanced protection and performance when fencing. The shoes also retain a constant and balanced landing reaction to ascertain the precision of each movement. The Hong Kong fencing athletes wore the asymmetric fencing shoes in the Rio 2016 Olympic Games.</p> <p>This technology won a silver medal at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.</p>

Project / Technology	Status / Progress
<p data-bbox="215 257 821 324"><b>Imaging Colour Measurement (“ICM”) System for Textile and Garment Industry</b></p> 	<p data-bbox="837 257 1500 548">HKRITA has collaborated with the Hong Kong Polytechnic University to develop this industry-leading ICM system, which offers high precision, accurate and repeatable colour measurement of varieties of fabrics with complex colour and pattern combinations. The system can provide an objective colour assessment in the supply chain of retailers, suppliers and buyers.</p> <p data-bbox="837 604 1500 862">A renowned textiles and apparel group has bought one of the ICM Phase II prototypes from HKRITA and has continued to collaborate with HKRITA for further system upgrade. HKRITA also signed a Memorandum of Understanding with one of the ICM industry sponsors in February 2017.</p>
<p data-bbox="215 1052 550 1086"><b>Textile Waste Recycling</b></p> 	<p data-bbox="837 1052 1500 1232">HKRITA has conducted a number of research projects on the feasibility of textile waste recycling by biological and chemical methods so as to develop a novel approach for textile waste treatments.</p> <p data-bbox="837 1288 1500 1467">These technologies aim to recover cotton and polyester fibre from textile waste via biological, hydrothermal and dissolution processes. The fibres recovered from textile waste can be reused in the textile industry.</p> <p data-bbox="837 1523 1500 1702">At present, HKRITA and a renowned international fashion brand have entered into a four-year partnership agreement to develop technologies to recycle blend textiles into new fabrics and yarns.</p> <p data-bbox="837 1758 1500 1904">HKRITA is also collaborating with the City University of Hong Kong and Shinshu University Japan to develop effective methods for recycling post-consumer textile.</p>

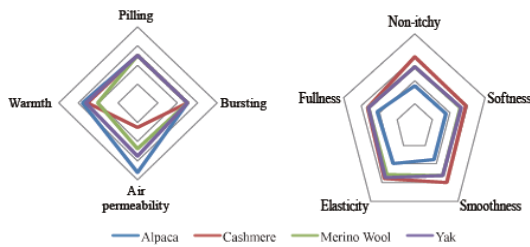
Project / Technology

Status / Progress

**Development of Fine Worsted Yak Yarns and Fabrics**



Yak Fabric Properties



HKRITA has developed light, thin and high quality yak knitted fabrics by overcoming difficulties such as short length, large dispersion of fibre length and low fibre cohesion of yak yarns. Apart from developing advanced spinning methods and apparatus for producing fine yak yarns, HKRITA has designed and optimised the knitting machine settings and parameters to make light, warm and soft yak knitted fabrics.

In addition, physical and functional properties of yak yarns have been analysed and compared to other fibres such as merino wool, cashmere and alpaca to facilitate the development of high quality yak fabrics and textile products.

This technology won a gold medal with Jury Commendation at the 45<sup>th</sup> International Exhibition of Inventions of Geneva 2017.

**Automotive Parts and Accessory Systems R&D Centre (“APAS”)  
Highlight of Operation in 2016-17**

**I. New R&D Projects and Industry Contribution (in \$million)**

	<u>2015-16</u>			<u>2016-17</u>		
	No. of New Projects	Project Cost	Industry Contribution	No. of New Projects	Project Cost	Industry Contribution
Platform	1	4.2	0.4 (10.0%)	1	4.5	0 (0%)
Collaborative	6	54.7	27.7 (50.6%)	3	18.1	8.2 (45.1%)
Seed	3	7.9	0.3 (3.5%)	8	19.2	0 (0%)
Total:	10	66.8	28.4 (42.5%)	12	41.8	8.2 (21.8%)
Public Sector Trial Scheme	3	3.3	n/a	4	3.5	n/a

*Note: Figures in brackets denote the level of industry contribution.*

**II. Operating Expenditure (in \$million)**



	2015-16	2016-17
Staffing	10.5	11.6
Accommodation	2.2	2.3
Equipment	0.8	1.3
Others	2.3	2.5
Total:	15.8	17.7


**III. Industry Income Received (in \$million)**

	2015-16	2016-17
Sponsorship for projects	22.65	6.40
Licensing/Royalty	-	0.02
Contract Services	0.61	1.55
Others	0.14	0.09
Total:	23.40	8.06

**IV. Progress of Selected Projects on R&D, Commercialisation and Use of R&D Outcomes in the Public Sector**

Project / Technology	Status / Progress
<p><b>Dual Channel 2-50 kW Fast Charging Station for Electric Vehicle (“EV”)</b></p> 	<p>APAS’s Dual Channel Fast Charger is a significant development for green transportation. It can charge two EVs at 50kW each and can shorten the charging time from an average of 7-8 hours to about 20 minutes.</p> <p>Four trials for the charger have been conducted at the Hong Kong International Airport, Water Supplies Department’s Lung Cheung Road Mechanical and Electrical Workshop, Hong Kong Police Force’s Siu Lek Yuen Operational Base, and Hong Kong Housing Society’s Wong Tai Sin Kai Tak Garden.</p> <p>More trials will be conducted in different locations. APAS is also developing higher power and faster charging stations.</p>
<p><b>Multi-standard Mobilised Fast Charger for EV</b></p>  	<p>APAS has successfully developed the first multi-standard mobile EV charger in Hong Kong. With this system, the battery of an EV can be recharged up to 50% in 20 minutes only. The system offers a highly flexible solution for roadside emergency charging and where charging stations are not available.</p> <p>APAS will conduct a trial project with the Hong Kong Automobile Association to further explore its market potential in 2017.</p> <p>This technology won a silver medal at the 44<sup>th</sup> International Exhibition of Inventions Geneva 2016.</p>

Project / Technology	Status / Progress
<p data-bbox="260 271 743 338"><b>A Smart Vehicle-to-Home (“V2H”) System for EV</b></p>  	<p data-bbox="871 271 1437 376">APAS is developing a Smart V2H system for convenient energy transfer between smart vehicles and households.</p> <p data-bbox="871 434 1437 797">The Smart V2H system can operate in two modes: vehicle-to-load, which provides electricity to electrical devices directly by a vehicle; and V2H which transfers electricity from a vehicle to a home energy storage system. Different bidirectional power flows will be adopted to facilitate the energy transfer among the EV, household, and the home energy storage system.</p> <p data-bbox="871 855 1437 960">APAS is exploring with a non-government organisation on a potential trial of this technology.</p>

Project / Technology	Status / Progress
<p data-bbox="260 271 722 338"><b>Bus Infotainment System (second generation)</b></p> 	<p data-bbox="869 262 1437 663">APAS has successfully developed the second generation of the bus infotainment system. Linking up a server with hundreds of display terminals, the upgraded system can provide more attractive features such as online programme content updates, online purchasing and enhanced human-machine interface, thereby enhancing passenger experience for different types of mass transportation.</p> <p data-bbox="869 701 1437 1028">The new system has already passed the installation type approval of Transport Department. The industry partner has commenced the installation work of the system on cross border buses in March 2017, with a view to installing the system on 400 buses in 3 years' time. It is also exploring the market potential of the system for high speed trains.</p>